

## Revision of the genus *Dasyhesma* Michener (Apoidea: Colletidae: Euryglossinae)

Elizabeth M. Exley

Department of Zoology and Entomology  
University of Queensland, Queensland 4072, Australia

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**Abstract** – The endemic Australian bee genus *Dasyhesma* known from two species is revised with the following nineteen (19) species described as new: *D. albula*, *D. argentea*, *D. areola*, *D. aurea*, *D. baeckea*, *D. boharti*, *D. brevivalpa*, *D. clypeata*, *D. coolgardensis*, *D. depressa*, *D. dilata*, *D. forrestii*, *D. galbina*, *D. lepidophyllae*, *D. muelleriana*, *D. scholtziae*, *D. simulata*, *D. spicata*, *D. syntoma*. All 21 species are known only from Western Australia.

A key enables separation of species. Known distributions are mapped.

### INTRODUCTION

Large numbers of new bee species are constantly being discovered in the Australian endemic subfamily Euryglossinae of the primitive family Colletidae. This is particularly true of larger species (> 6mm) from Western Australia where Dr Terry Houston of the Western Australian Museum has collected from the often endemic wild flowers characteristic of the south-western area of that state. Among the collections are two groups of robust bees in which the head and mesosoma are coarsely and strongly punctate and the propodeum in profile is almost completely vertical. One of these groups in which females are about 10mm long is currently considered the *crabronica* species-group of the genus *Euhesma* (Exley 2002). The second group in which females are 6–9mm long is here considered to be in the genus *Dasyhesma* Michener.

### Relationships

Female *Dasyhesma* species are readily distinguished from the *Euhesma crabronica* species-group by size, wing venation – junction of 2<sup>nd</sup> recurrent vein and 2<sup>nd</sup> submarginal cell cf. Figure 2 with Figure 1 in Exley (2002), metasomal colour markings and basitibial plate (closed in *crabronica* group) open i.e. not completely bounded by carinae in *Dasyhesma*. Although few males were recognised in the *crabronica* group, the genitalia, seventh and eighth metasomal sterna (Exley, 2002 Figures 5–10) are quite different from those of *Dasyhesma* (Figures 16–34).

It is possible the *E. crabronica* group will be removed from the genus *Euhesma* eventually. There are still too many undescribed species and groups of species placed in the genus to make final decisions about its boundaries.

Dissection of *Dasyhesma* males has revealed

similarities with the genus *Callohesma*. The seventh and eighth metasomal sterna (Figures 19–30) resemble those of some *Callohesma* species (Exley, 1974, Figures 5, 6).

### Taxonomy

Michener (1965) erected *Dasyhesma* for *D. robusta* known from nine females and one male from Western Australia. He recognised the similarity between *D. robusta* and a species described by Rayment (1935) and named *Euryglossimorpha abnormis*. It was known from one female also from Western Australia. Michener (1965) reclassified Rayment's species into a new subgenus *Dermatohesma* of the genus *Euryglossa* Smith. Subsequently, Michener (2000) synonymized the two taxa. He rejected *Dermatohesma* and selected *Dasyhesma* as the name of the genus now with two species *D. robusta* and *D. abnormis*.

It is now clear the genus contains many species and twenty-one are recorded in this paper. Their descriptions are not complete as males for many are unknown. Sex associations are primarily on collection data but many sites are close together and accuracy is not guaranteed.

### MATERIAL AND METHODS

Although the majority of specimens viewed are recently collected and beautifully set, some old specimens are in poor condition and often clogged with nectar and pollen. These I have included and named as they record the genus from different geographical areas.

Most specimens are females and the association of the males available is not always clear, so the key presented is for females alone.

In descriptions of species, 'relative head

measurements' express concisely the size relation between measurements on one head. Some descriptions are fuller than others but characters important for species recognition are always given.

Houston (2000) used code numbers for undescribed or unidentified bees in the Western Australian Museum that had been taken on wild flowers. When available on specimens these code numbers are given in the Remarks section of descriptions.

Descriptions were written after examination with a Wild stereomicroscope (Wild M5, Heerbrugg, Switzerland).

The following abbreviations have been used:

AM: Australian Museum, Sydney;

ANIC: Australian National Insect Collection, Canberra;

KU: Snow Entomological Collection, University of Kansas, Lawrence;

LAM: Natural History Museum of Los Angeles County;

QM: Queensland Museum;

RMBM: R.M. Bohart Museum of Entomology, University of California, Davis;

UQIC: University of Queensland Insect Collection, Brisbane;

WAM: Western Australian Museum, Perth;

T1, T2 etc.: metasomal terga 1, 2 etc.

S1, S2 etc.: metasomal sterna 1, 2 etc.

VP used in locations stands for "Vermin Proof" (Fence).

#### Plant Associations

All except one species described here in which plant association is recorded were taken on flowers of the plant family Myrtaceae (usual for Euryglossinae). Females were found on the following genera: *Baeckea* (five species), *Scholtzia* (one species), *Chamelaucium* (one species) and *Verticordia* (nine species).

*Verticordia* is an Australian genus in which two species were shown to be almost certainly pollinated primarily by two bee species of the euryglossine genus *Euhesma* Michener (Houston, Lamont, Radford and Errington, 1993). Other species of *Verticordia* were subsequently widely sampled for bees by Dr Houston and this paper is one result. Female *Dasyhesma* bees on different species of *Verticordia* are distinct and are here described as separate species.

There are about 100 species in this entirely Australian plant genus found mostly in the south-west botanical province of Western Australia where spectacular displays are formed in spring and summer often in a mass of one colour.

*Verticordia* was divided by George (1991) into three subgenera on the basis of plant morphology. The two *Euhesma* bees mentioned above were associated with plants in the subgenus *Chrysoma* in

which the form of the flower is least complex. All the plants associated below with *Dasyhesma* bees are in the subgenus *Epepephes* where flowers are more complex and all but one are in the section considered most complicated of all.

Whether *Dasyhesma* bees play a role in pollination is unknown. The specific names chosen for many of the new species reflect their close association with particular plants.

### Genus *Dasyhesma* Michener

#### Type Species

*Dasyhesma robusta* Michener, 1965: by original designation.

The following description relates to members of the genus. It expands the diagnosis in Michener (2000).

#### Description

##### Female

Length 6–9mm; head and thorax, dark brown or black, strongly punctate; propodeum black, in profile subvertical with narrow sloping upper zone; propodeal triangle granular; metasoma predominately black or red or orange; antennal bases above middle of face; pedicel longer than first flagellar segment; eyes converging below; fronto-clypeal suture often absent; mandible with broad, subapical tooth; labial palps with segment 2 smallest; segments 1, 3, and 4 usually about equal; facial foveae linear, often broad or partially expanded, less than 0.5 length of eye; sides of pronotum in front of lobes shining, often impunctate; basitibial plate open at apex; inner hind tibial spur pectinate; forewing (Figure 2) with costal margin of marginal cell at least 1.5 x length of pterostigma; second submarginal cell more than half as long as first, strongly narrowed towards marginal cell, macrotrichia on whole of wing; foveae of second tergum of metasoma shallow; metasomal terga dull, with dense, fine punctation; longitudinal median groove on T<sub>1</sub> ends dorsally in a sharp "shelf" seen in profile.

##### Male

Head and thorax black, strongly punctate; eyes converging below; antennae long, pedicel longer than first flagellar segment, middle flagellar segments about as long as wide; propodeum black; metasomal terga with fine, dense punctation, T7 with larger punctures and an impunctate median longitudinal ridge. Genitalia and hidden sterna Figures 16–34.

Two size groups occur among both sexes: in females, long (about 8mm) and short (6.5–7mm). Although fewer males are available and there is no

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certainty about identification, it seems as though very small males are associated with short females. One feature of the genus is the relative similarity of the sexes – not common among Euryglossinae.

The genus can be divided into two main groups:

## Group 1:

## Females

Robust, stocky bees in which the head is wider than long (Figure 1), with antennae short with all flagellar segments except last wider than long; labrum oval; underside of prementum partly roughened; in many virtually no interspace between punctures on mesoscutum; tarsal claws with small tooth beyond middle (Figure 14); pterostigma nearly parallel-sided before base of vein r (Figure 2); fore tibial spur with malus not serrate; foretarsi with specialised setae; in dorsal view of most basitarsus margined anteriorly with flattened simple setae, posteriorly with pothook setae; segments 2, 3, 4 each with a set of long pothook setae posteriorly and much shorter set of simple setae anteriorly.

## Males

Genitalia with penis valves extended distally (Figures 16, 17); S8 with shaft not expanded and shoulders with setae (Figures 19, 20).

Species included: *D. abnormis*, *D. albula*, *D. aurea*, *D. baeckea*, *D. boharti*, *D. brevipalpa*, *D. coolgardensis*, *D. dilata*, *D. scholtziae*.

## Group 2:

## Females

More slender bees with heads that appear longer than wide due to elongation of clypeus and eyes and sometimes malar area (Figure 3); antennae longer with middle flagellar segments almost as long as wide; labrum triangular; underside of prementum polished, not roughened; polished interspaces separate punctures on scutum; tarsal claws with a large diverging inner tooth and outer ramus forming a right angle (Figure 13); sides of pterostigma not quite so nearly parallel sided before base of vein r; fore tibial spur with malus serrate (Figure 15); foretarsi more hairy than in Group 1. Basitarsi with thick, somewhat flattened simple setae ventrally; segments 2–5 with very numerous curly pothook setae ventrally; all segments with very long apparently simple setae often forming a tangle dorsally.

## Males

If large (6–7mm), genitalia with penis valves not extended distally (Figure 18); S8 with shaft expanded and shoulders without setae (Figures 21, 22).

Species included: *D. areola*; *D. depressa*, *D. forrestii*, *D. galbina*, *D. muelleriana*, *D. robusta*, *D. simulata*, *D. spicata*, *D. syntoma*.

Three species in which males associated on collection data are smaller (4–5mm) possess different terminalia. On whole specimens a small distal end of S8 is visible (cf. Figures 24, 25, 32 with Figures 19–23.). On dissection the genitalia may not show a gonocoxite projection (Figure 31); S7 has two elongate distal lobes heavily coated with plumed setae outside (Figures 26, 27). The lobes may curl under so the setae appear also on the inner side (Figure 26); the shaft of S8 is long and narrow (Figures 24, 25). Its strong curvature (Figure 32) contrasts with S8 of Group 1 (Figure 34) and large males of Group 2 (Figure 33). In these species the propodeum is less completely vertical than in other *Dasyhesma* males and misidentification cannot be dismissed.

Species included: *D. argentea*, *D. clypeata*, *D. lepidophyllae*.

Key to Females of the Genus *Dasyhesma*

- 1 Head as wide as thorax with antennae short and all flagellar segments except last wider than long [Group 1] ..... 2
  - Head narrower than thorax with middle flagellar segments of antennae almost as long as wide [Group 2] ..... 10
- 2(1) Metasoma predominantly black with posterior margins of terga pale and translucent ..... 3
  - Metasoma predominantly orange/yellow .. 5
- 3(2) Mesonotum with punctures very close with essentially no interspaces ..... 4
  - Mesonotum with punctures separated by more than diameter of one puncture .....
    - ..... *D. dilata*, sp. nov.
- 4(3) Setae on T<sub>5</sub> and T<sub>6</sub> black; vertex lateral to median ocellus raised and impunctate .....
  - ..... *D. scholtziae* sp. nov.
  - Setae on T<sub>5</sub> and T<sub>6</sub> golden; vertex not so raised and impunctate .....
    - ..... *D. abnormis* (Rayment)
- 5(2) Metasoma foveae black ..... 6
  - Metasoma foveae reddish-orange ..... 8
- 6(5) Length about 9mm; mesonotum with punctures virtually touching .....
  - ..... *D. aurea*, sp. nov.
  - Length about 8mm; mesonotum with punctures separated by at least diameter of one puncture ..... 7
- 7(6) Pronotal lobe black; facial foveae not curved towards lateral ocelli, widest below .....
  - ..... *D. boharti*, sp. nov.

- Pronotal lobe yellow posteriorly; facial foveae curved towards lateral ocelli, widest above ..... *D. coolgardensis*, sp. nov.
- 8(5) Length 8–9mm; mesonotum with punctures virtually touching ..... *D. albula*, sp. nov.  
Length 6.5–7mm; mesonotum with punctures separated by more than diameter of one puncture ..... 9
- 9(8) Clypeus densely punctured; labial palps small with segment 4 longer than segment 3; facial foveae reaching level of mid ocellus ..... *D. brevipalpa*, sp. nov.  
Clypeus sparsely punctured; labial palps with length of segments 3 & 4 about equal; facial foveae reaching level of lateral ocelli ..... *D. baeckea*, sp. nov.
- 10(1) Malar area distinct, about half as long as width of mandibular base; mandibles basally yellow-brown .....  
..... *D. robusta* Michener  
Malar area not obvious in most; mandibles basally black ..... 11
- 11(10) Anterior margin of clypeus markedly concave leaving large space between it and labrum (Figure 12) .....  
..... *D. areola*, sp. nov.  
Anterior margin of clypeus straight or slightly concave with at most small space between it and labrum (Figures 10, 11) ..  
..... 12
- 12(11) Clypeus and supraclypeal area concave in profile (Figure 7) ..... *D. depressa*, sp. nov.  
Clypeus and supraclypeal area not concave in profile ..... 13
- 13(12) All legs orange; labial palps with last three (3) segments pale yellow; antennal pedicel yellowish ..... *D. galbina*, sp. nov.  
All legs not orange; labial palps with last three (3) segments not pale yellow; antennal pedicel not yellowish ..... 14
- 14(13) Legs 2 and 3 orange ..... 15  
Legs 2 and 3 not orange ..... 17
- 15(14) Length about 8mm; labial palps with last two (2) segments pale yellow; all tarsal segments of legs 2 and 3 orange .....  
..... *D. simulata*, sp. nov.  
Length about 7mm; labial palps black or dark brown; last tarsal segment of legs 2 and 3 black/dark brown ..... 16
- 16(15) Fore legs with tibiae yellow dorsally; labrum yellowish brown .....  
..... *D. syntoma*, sp. nov.
- Fore legs black with only very base of tibiae yellowish; labrum black .*D. lepidophyllae* sp. nov.
- 17(14) Genal area not visible below anterior part of eye when viewed from side (Figure 9) ...  
..... 18  
Genal area clearly visible below anterior part of eye when viewed from side (Figure 5) ..... 19
- 18(17) Pterostigma yellow, opaque, margined with dark brown; body length about 7mm .....  
..... *D. muelleriana*, sp. nov.  
Pterostigma transparent, not yellow, margined with dark brown; body length less than 7mm ..... *D. argentea*, sp. nov.
- 19(17) Viewed from the side, head and mesosoma fringed with long white setae .....  
..... *D. forrestii*, sp. nov.  
Viewed from the side, head and mesosoma not fringed with long white setae ..... 20
- 20(19) Mid legs black ..... *D. clypeata*, sp. nov.  
Mid legs with tibiae and tarsi orange .....  
..... *D. spicata*, sp. nov.

#### GROUP 1

Females of three (3) species have the metasoma dark red/black with posterior margins of terga pale and translucent. They can be separated by the sculpture of the vertex and mesonotum.

The metasoma of females of the other six species described below is predominantly orange. Two of these are large (about 9mm long) and distinguished easily on colour characters. Males associated with one are also large. Males are associated with only one of the species with shorter females and they too are small. None of the species was recorded on *Verticordia*.

#### *Dasyhesma abnormis* (Rayment)

*Euryglossomorpha abnormis* Rayment, 1935: 664–5

*Euryglossa (Dermatohesma) abnormis* (Rayment) Michener, 1965: 91–92

*Dasyhesma abnormis* (Rayment) Michener, 2000: 215

#### Type

Western Australia: holotype ♀; Gngangara, December, B.A. O'Connor (ANIC).

Both the head and metasoma have been glued to a broken mesosoma. The right foreleg is the only complete leg.

#### Additional Material Examined

Western Australia: 2♀, 5.8km SE of Cataby, 8



January 1983, C.A. Howard and T.F. Houston, on flowers of *Baeckea* (WAM).

## Description

### Female

See Michener (1965) pp.91–92 for full description.

Length about 8.0mm; wing length about 5.5mm. Relative head measurements: width 7.1; length 6.3; eye length 4.6; lower interocular distance 3.8; upper interocular distance 4.7; clypeo-antennal distance 1.0; interantennal distance 1.4; antennocular distance 1.1; interocellar distance 1.3; ocellular distance 1.2.

The clypeus on the Cataby specimens is larger and more shining than in the holotype. In both, however, the foveae of the metasoma are black, flat and wide (just over 2 x as long as wide). Setae on  $T_5$  and  $T_6$  are golden.

### *Dasyhesma albula* sp. nov.

Figures 2, 14

### Types

Western Australia: holotype ♀, 54km, 27°E of N from Kalbarri on VP Fence, 27°16'02"S, 114°25'15"E, 19 November 1998, T.F. Houston, on flowers of *Baeckea blackallii* (WAM). Paratypes: Western Australia: 4 ♀, same data as holotype (WAM).

### Additional Material Examined

Western Australia: 4 ♀, 13km S of Wannoo (26.49 S, 114.37E,) 24 October 1996, T.F. Houston, on flowers of *Thryptomene strongylophylla* (WAM).

## Description

### Female

Length about 9.0mm; wing length about 5.0mm. Relative head measurements: width 6.8; length 5.6; eye length 4.6; lower interocular distance 3.3; upper interocular distance 4.5; clypeo-antennal distance 0.7; interantennal distance 1.1; antennocular distance 1.1; interocellar distance 1.2; ocellular distance 1.2.

This large species is very similar to *D. aurea*. Most clear distinctions relate to colour – whereas all setae on *D. aurea* are long and golden, on *D. albula* they are white. The metasomal foveae of *D. albula* are very difficult to distinguish being of similar colour to the metasoma (orange). They are flat, about 3 x as long as wide. In *D. aurea*, these foveae are black.

Punctuation of the supraclipeal area and paraocular areas is more dense than in *D. aurea* and there are differences in the wing venation of the forewings particularly in the size of the second sub-marginal cell.

## Remarks

Code numbers in Houston (2000): F 306

## Etymology

The specific name is from the Latin and refers to the white pubescence.

### *Dasyhesma aurea* sp. nov.

Figures 17, 19, 29, 34

## Types

Western Australia: holotype ♀, East Yuna Nature Reserve, 34km WNW Mullewa, 12–14 September 1987, T.F. Houston, ex. nest (WAM). Paratypes: Western Australia: 5 ♀, 1 ♂, same data as holotype; 2 ♂, same data on 23–24 September 1983, C and T. Houston, on foliage of *Acacia* (flowerless) (WAM); 12 ♀, same data as holotype except on flowers of *Baeckea*; 3 ♀, same data as holotype except 13–16.ix.1984, entering or leaving burrow in bare sand.

### Additional Material Examined

Western Australia: 8 ♀, 7 ♂, 5km 23°N of W from Eurardy HS; 27 August 1999, T.F. Houston, on flowers or hovering close to ground beneath flowers of *Jacksonia cupulifera* (Fabaceae); 5 ♀, Denham-Hamelin Rd, 14km NW Tamala turnoff, 28 August 1997, T.F. Houston and P. Mathiasen, on flowers of *Malleostemon roseus* (WAM).

## Description

### Female

Length about 9.0mm; wing length about 5.5mm. Relative head measurements: width 6.8; length 5.5; eye length 4.5; lower interocular distance 3.6; upper interocular distance 4.5; clypeo-antennal distance 0.5; interantennal distance 1.0; antennocular distance 1.0; interocellar distance 1.2; ocellular distance 1.1.

Clypeus seen from the side gently convex; facial foveae broad, reaching level of lateral ocelli, basitibial plate margined by two carinae; inner hind tibial spur with 4–5 teeth; metasomal foveae flat, black, about 3 x as long as wide.

Head and mesosoma black with antennal flagellar segments 3–10 yellow ventrally; metasoma yellow/orange with black infuscation especially on  $T_1$ ; fore legs dark brown with tibiae yellowish dorsally; mid and hind legs yellow/orange; forewings with veins and pterostigma brown; head including upper half of clypeus heavily punctured, mesonotum very heavily punctured. Pubescence golden.

### Male

Length about 7.0mm; wing length about 5.0mm. Relative head measurements: width 5.7; length 4.5; eye length 3.6; lower interocular distance 2.7; upper

interocular distance 3.8; interantennal distance 0.9; antennocular distance 0.8; interocellar distance 1.1; ocellocular distance 1.0.

Most obvious feature is the heavy pubescence – longer on the mesonotum and legs than on ventral thorax, also more on metasomal dorsum than in other species. Hairs on vertex and dorsal body surface slightly golden, on lower face and genae, and ventral body surface, white. Head and mesosoma black, metasoma dark brown. Legs dark brown with distal ends of femora and tibiae and tarsi partially yellow.

Genitalia: Figure 17.

Seventh metasomal sternum: Figures 29, 34.

Eighth metasomal sternum: Figure 19.

#### Remarks

Code numbers in Houston (2000): F300/M264.

#### Etymology

The specific name is from the Latin and refers to the golden pubescence especially of the female. This clearly distinguishes this species from *D. albula*.

#### *Dasyhesma baeckea* sp. nov.

Figure 1

#### Types

**Western Australia:** holotype ♀, 10km WNW of Eurardy HS 27°32'18"S, 114°34'54"E, 21–24 October 1998, T.F. Houston and O. Mueller, on flowers of *Baeckea* (WAM). Paratypes: **Western Australia:** 9♀, same data as holotype (WAM).

#### Additional Material Examined

**Western Australia:** 1♀, 23km SE of Kalbarri, 29 October 1996, T.F. Houston, on flowers of *Baeckea* sp. (WAM)

#### Description

##### Female

Length about 7.0mm; wing length about 5.0mm. Relative head measurements: width 6.1; length 5.1; eye length 4.0; lower interocular distance 3.2; upper interocular distance 3.9; clypeo-antennal distance 0.6; interantennal distance 1.1; antennocular distance 1.0; interocellar distance 1.0; ocellocular distance 0.9.

Clypeus gently convex seen from the side; facial foveae a polished trough as broad as base of scape, reaches level of lateral ocelli and turns in; basitibial plate indicated by anterior and posterior carinae; inner hind tibial spur with six (6) teeth; metasomal foveae about 2.5 x as long as wide, difficult to distinguish from surface of T<sub>2</sub>.

Head and mesosoma black with antennal flagellum yellowish ventrally, metasoma orange;

fore legs black with tip of femur, tibia and tarsi mostly orange; mid and hind legs orange with coxae and trochanters black; forewings with veins dark brown (R black), pterostigma yellow-orange; clypeus polished, lightly punctured, rest of head and mesosoma heavily punctured; propodeal triangle granular; long white hair on ventral body surface; T<sub>5</sub> with long, golden plumose setae on surface and posterior margin; similar hairs obscure surface of T<sub>6</sub>.

#### Remarks

Code numbers in Houston (2000): F400/F305?

#### Etymology

The specific name refers to the plant genus *Baeckea* from which five of the species here recorded were collected.

#### *Dasyhesma boharti* sp. nov.

#### Types

**Western Australia:** holotype ♀, Carrabin, 18 November 1979, R.M. Bohart (QM). Paratype: **Western Australia:** 1♀, same data as holotype (RMBM).

#### Description

##### Female

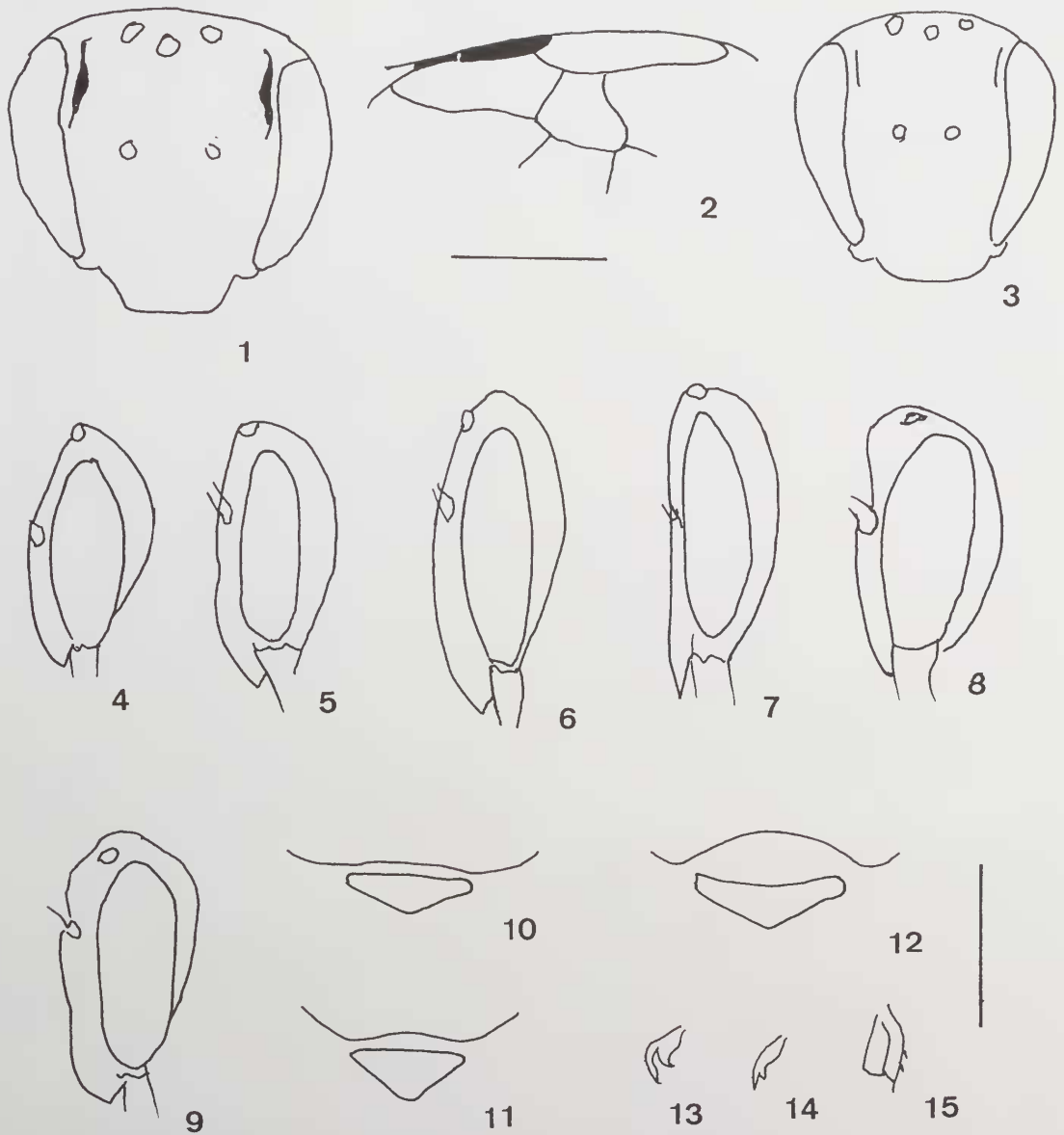
Length about 8.0mm; wing length about 5.0mm. Relative head measurements: width 6.3; length 5.4; eye length 3.9; lower interocular distance 3.4; upper interocular distance 4.0; interantennal distance 1.1; antennocular distance 0.9; interocellar distance 1.1; ocellocular distance 1.0.

Clypeus gently convex seen from the side; facial foveae linear, wide, reaching level of lateral ocelli; basitibial plate margined by carinae; inner hind tibial spur with four teeth; metasomal foveae flat, black, 3 x as long as wide.

Head and mesosoma black with antennal flagellum yellowish ventrally; metasoma yellow-brown with black infuscations; forelegs brown with tibiae and tarsi orange; mid and hind legs orange; forewings with veins and pterostigma brown, clypeus with punctures less dense than on frons. Pubescence white, longer on ventral body surface and legs, most extensive and cream on metasomal segments 5 and 6 (dorsal and ventral).

#### Etymology

The specific name honours the collector Professor R.M. Bohart and the Museum of Entomology, University of California, Davis, United States of America, where I was able to study the bee collection in 1987.



Figures 1–15 Females of *Dasyhesma* spp. 1, 3: Heads of *D. baeckea* and *D. syntoma*. 2: Section of forewing of *D. albula*. 4–9: Side view of heads of *D. argentea*, *D. clypeata*, *D. areola*, *D. depressa*, *D. scholtziae*, *D. muelleriana*. 10–12: Anterior margin of clypeus and labrum of *D. clypeata*, *D. galbina*, *D. areola*. 13–14: Hind tarsal claws of *D. galbina*, *D. albula*. 15: Fore tibial spur of *D. forrestii*. Scale lines: 1–9 = 1mm; 10–15 = 0.5mm

*Dasyhesma brevipalpa* sp. nov.

Figures 23, 28

**Types**

**Western Australia:** holotype ♀, 13km N of Eurardy HS, 27°27'00"S, 114°41'17"E, 25 October 1998, T.F. Houston and O. Mueller, on flowers of *Baeckea* (Myrtaceae) (WAM). Paratypes: **Western Australia:** 3 ♀, same data as holotype (WAM).

**Additional Material Examined**

**Western Australia:** 2 ♂, 9km 10°N of W from Eurardy HS; 6 November 1999, T.F. Houston, flying near flowers of *Verticordia areola* and others; 8 ♀, 1 ♂, 9km NNE of Eurardy HS on NW Coastal Highway 25–28 October 1996, T.F. Houston on flowers of *Baeckea* sp.; 2 ♂, same data one on flowers of *Pileanthus* sp. other on or flying around flowers of *Chamelaucium oenanthum* (all in WAM).

## Description

### Female

Length about 6.5mm; wing length about 4.0mm. Relative head measurements: width 5.3; length 4.3; eye length 3.5; lower interocular distance 2.3; upper interocular distance 3.4; clypeo-antennal distance 0.4; interantennal distance 0.9; antennocular distance 0.9; interocellar distance 1.0; ocellocular distance 0.9.

Clypeus flattish medianly; facial foveae trough-like, widest medianly, reaching level of mid ocellus; labial palps very short with segments 2 and 3 about equal and 1 and 4 larger but about equal; basitibial plate with both carinae broken into tubercles; inner hind tibial spur with at least four large teeth; metasomal foveae about 3 x as long as wide, flat, light brown. Head and mesosoma black with antennal flagellum yellowish ventrally and mandibles black basally, then amber before red tips; fore and mid legs black with femora distally, tibiae and tarsi orange; hind legs orange; forewings with veins and margins of pterostigma dark brown, inside pterostigma yellowish; metasoma orange.

Head more densely punctured than central mesonotum. Pubescence white, longer on venter and legs, dense around antennal bases and pronotal lobes, very dense and cream on posterior margin of  $T_5$  and on  $T_6$ .

### Male

Length about 5.0mm; wing length about 3.0mm. Relative head measurements: width 4.3; length 3.5; eye length 2.8; lower interocular distance 2.0; upper interocular distance 3.0; interantennal distance 0.7; antennocular distance 0.5; interocellar distance 0.9; ocellocular distance 0.8.

The sexes are associated primarily on the basis of both having short labial palps. An obvious feature is the long white pubescence on the lower half of the face, ventral head, thorax and legs; forewings as in female; colours as in female with more brown on legs and metanotum dark brown with venter yellowish. Males can be recognised by short palps, yellow labrum and mandibles (except tip), yellowish venter and legs distally.

Seventh metasomal sternum: Figure 28.

Eighth metasomal sternum: Figure 23.

### Remarks

Code numbers in Houston (2000): F305/M268.

### Etymology

The specific name comprises two Latin words for short palps, characteristic of this species.

*Dasyhesma coolgardensis* sp. nov.

## Type

Western Australia: holotype ♀, 25 (ml) S, Coolgardie, 28 October 1958, E.F. Riek (ANIC).

## Description

### Female

Length about 7.0mm; wing length about 5.0mm. Relative head measurements: width 5.8; length 5.1; eye length 3.8; lower interocular distance 3.5; upper interocular distance 3.7; clypeo-antennal distance 0.7; interantennal distance 0.9; antennocular distance 1.0; interocellar distance 1.0; ocellocular distance 0.9.

Clypeus gently convex seen from the side; facial foveae with top greatly expanded and curved into lateral ocelli; basitibial plate margined on each side by a carina with terminal tubercle; inner hind tibial spur with at least four (4) teeth (not clearly visible); metasomal foveae flat, black, 3 x as long as wide.

Head and mesosoma black with antennal flagellum yellowish beneath; metasoma yellowish with black infuscations in middle of  $T_1$ ,  $T_2$ ,  $T_3$  and almost covering  $T_4$  and  $T_5$ ; legs predominantly yellow/orange with most segments showing some brown incursions and all tarsi virtually dark brown; forewings with veins and pterostigma brown; punctation fairly uniform on head.

Pubescence plentiful and yellowish on head and mesosoma dorsally, longer and white ventrally and on legs; metasoma with long white setae ventrally, short dorsally except long and yellowish on  $T_5$ ,  $T_6$ .

### Remarks

The legs of the only specimen seen of this species exhibit characteristics of females of Group 2 – pretarsal claws with the outer ramus right angled and the inner ramus large and diverging. In addition, the pubescence of the foretarsi resembles that seen in Group 2.

### Etymology

The specific name reflects where it was collected – to date, the most easterly site for the genus.

*Dasyhesma dilata* sp. nov.

### Types

Western Australia: holotype ♀, 3.5–5.5km S of Yellodine (31°18'S, 119°39'E), 27 October 1978, T.F. Houston, on flowers of *Baeckea* ? *leptospermoides* (WAM). Paratypes: Western Australia: 2♂, same data as holotype (WAM).

## Description

### Female

Length about 8.0mm; wing length about 5.0mm.



Relative head measurements: width 6.8; length 5.6; eye length 4.3; lower interocular distance 3.7; upper interocular distance 4.4; clypeo-antennal distance 0.5; interantennal distance 1.2; antennocular distance 1.2; interocellar distance 1.1; ocellocular distance 1.2.

Similar to other Group 1 species in which the metasoma is dark red/black with posterior margins of terga pale and translucent (i.e. *D. abnormis* and *D. scholtzia*). This species differs in the sculpture of the centre of the scutum where punctures are much farther apart (more than the diameter of one puncture). In the other species there is virtually no space between punctures.

#### Male

Length about 6.5mm; wing length about 4.5mm. Relative head measurements: width 5.4; length 4.3; eye length 3.2; lower interocular distance 2.8; upper interocular distance 4.5; interantennal distance 0.9; antennocular distance 0.7; interocellar distance 1.0; ocellocular distance 1.0.

Head and mesosoma black, metasoma black/dark brown dorsally, yellowish ventrally. Legs black/dark brown with ends of femora and most of tibiae and tarsi yellowish.

#### Remarks

This species is the only one of the three species of Group 1 in which the metasoma is predominantly black with interspace between the punctures of the mesonotum.

#### Etymology

The specific name is from the Latin and refers to the punctures of the middle of the mesoscutum which are not almost touching, they are 'spread out'.

#### *Dasyhesma scholtziae* sp. nov.

Figures 8, 16, 20

#### Types

**Western Australia:** holotype ♀, Melaleuca Park Nature Reserve, 12km NE Wanneroo, 12 January 1996, T. Houston and C. Boase, on or about white flowers of *Scholtzia* (Myrtaceae) (WAM). Paratypes: **Western Australia:** 4♂, same data as holotype; 2♀, Forrestdale Lake Reserve, 25km SSE Perth, 9 February 1996, T.F. Houston and C.K. Boase, on flowers of *Scholtzia* (WAM).

#### Additional Material Examined

**Western Australia:** 4♀, 6.5km SSE Regans Ford, 8 January 1983, C.A. Howard and T.F. Houston on flowers of *Scholtzia*; 1♀, Moore River National Park, 31 December 1989, T.F. Houston, on flowers of *Scholtzia*; 1♀, Bullsbrook, A. Douglas, number 46-2576 (WAM).

#### Description

##### Female

Length about 8.0mm; wing length about 5.0mm. Relative head measurements: width 6.7; length 5.5; eye length 4.0; lower interocular distance 3.2; upper interocular distance 4.5; clypeo-antennal distance 0.6; interantennal distance 1.0; antennocular distance 1.0; interocellar distance 1.4; ocellocular distance 1.2.

Facial foveae about 0.25 x length of eye; genal area about 0.25 x width of eye seen from side; gastral foveae almost 4 x as long as wide; basitibial plate about 3.3 x length of hind tibia; inner hind tibial spur with 6–8 teeth; head with punctures closest on supraclypeal area; vertex lateral to median ocellus raised and almost impunctate; mesosoma with virtually no space between punctures; metasomal terga dull, minutely roughened without punctures.

Antennae black with flagellar segments yellow ventrally; legs dark brown with fore tibiae yellowish; metasoma dark brown/black with posterior margins of terga and sterna translucent.

Pubescence white, most abundant dorsally around antennal bases, as occipital fringe, on metanotum, sides of propodeum; long white setae on ventral body and legs; long dense black setae on  $T_5$ .

##### Male

Length about 5.5–6.0mm; wing length about 4.0mm. Relative head measurements: width 5.0; length 4.0; eye length 3.1; lower interocular distance 2.4; upper interocular distance 3.8; interantennal distance 0.9; antennocular distance 0.4; interocellar distance 1.2; ocellocular distance 1.0.

Colour as in female with more yellow on legs and antennal flagella with basal 4–6 segments entirely yellow.

Pubescence as in female with more long white setae on lower face and progressively longer fringe on posterior margins of  $S_3$ – $S_7$ .

#### Remarks

The raised, almost impunctate areas lateral to the median ocellus in both sexes have been seen nowhere else. Distinctive features of males also include the very strongly converging eyes and the bi-coloured antennae not viewed elsewhere.

The specimen in WAM from Bullsbrook was labelled a paratype of *D. robusta* by Michener.

Code numbers in Houston (2000): F303/M266.

#### Etymology

The specific name refers to the plant on which specimens were collected.

## GROUP 2

The metasoma of females of this group is predominantly orange/red or brown. In *D. robusta*, the type species of the genus, the metasoma of some specimens is predominantly dark red/black with posterior margins of terga pale and translucent as in three species of Group 1.

Except for *D. clypeata* (found on *Chamelaucium* sp.) and *D. robusta* (no record), all species in this group were taken on *Verticordia* spp. with a different bee species on each *Verticordia* species. This of course suggests they might play a role in pollination. An exception occurred however in *V. dichroma* on which three *Dasyhesma* species were recorded. Two with similar conspicuously lengthened labial palps were on separate varieties *V. dichroma dichroma* and *V. dichroma syntoma*. The third species also occurred on the latter.

*Dasyhesma areola* sp. nov.

Figures 6, 12, 21

## Types

**Western Australia:** holotype ♀, 9km 10°N of W from Eurardy HS, 27°32'53"S, 114°34'57"E, 6 November 1999, T.F. Houston, on flowers of *Verticordia areola* (WAM). Paratypes: **Western Australia:** 5♀, same data as holotype; 2♂, same data, flying near flowers of *Verticordia areola* and others (WAM, ANIC, UQIC).

## Additional Material Examined

**Western Australia:** 2♀, 13km 35°S of W from Eurardy HS; 2♀, 1♂, 56km 33°E of N from Kalbarri on VP Fence, 28 October 1998, T.F. Houston and O. Mueller, on flowers of *Verticordia areola* (WAM).

## Description

## Female

Length about 8.0mm; wing length about 5.0mm. Relative head measurements: width 5.3; length 5.1; eye length 4.2; lower interocular distance 2.8; upper interocular distance 3.3; interantennal distance 0.5; antennocular distance 0.8; interocellar distance 1.0; ocellocular distance 0.7; labrum length 0.5; 3.5–4 x as wide as long.

Anterior margin of clypeus concave, in all specimens seen separated from labrum creating a space about the size of the labrum (Figure 12); genal area seen from the side almost absent behind anterior third of eye (Figure 6); basitibial plate margined by carinae with three tubercles at end of posterior carina; inner hind tibial spur with 5 teeth; foveae of second tergum of metasoma not evident.

Head and mesosoma black with last seven antennal flagellar segments brown ventrally; forelegs black; midlegs with coxa, trochanter and

femur black, remainder orange with black infusions; hind leg yellow-orange; metasoma yellow-orange with dark incursions on segments 1–3 in some.

## Male

Length about 7.0mm; wing length about 4.5mm. Relative head measurements: width 4.5; length 4.5; eye length 3.5; lower interocular distance 2.4; upper interocular distance 2.8; interantennal distance 0.3; antennocular distance 0.8; interocellar distance 0.8; ocellocular distance 0.8; labrum length 0.2.

Space between labrum and clypeus as in female; gena as in female.

Head and mesosoma black, legs and metasoma dark brown.

Eighth metasomal sternum : Figure 21.

## Remarks

Code numbers in Houston (2000): F398/M363.

## Etymology

The specific name is from a Latin word for small space, and refers to the separation of the labrum from the clypeus. It is also the name of the species of *Verticordia* on which all specimens were collected.

*Dasyhesma argentea* sp. nov.

Figure 4, 31, 32

## Types

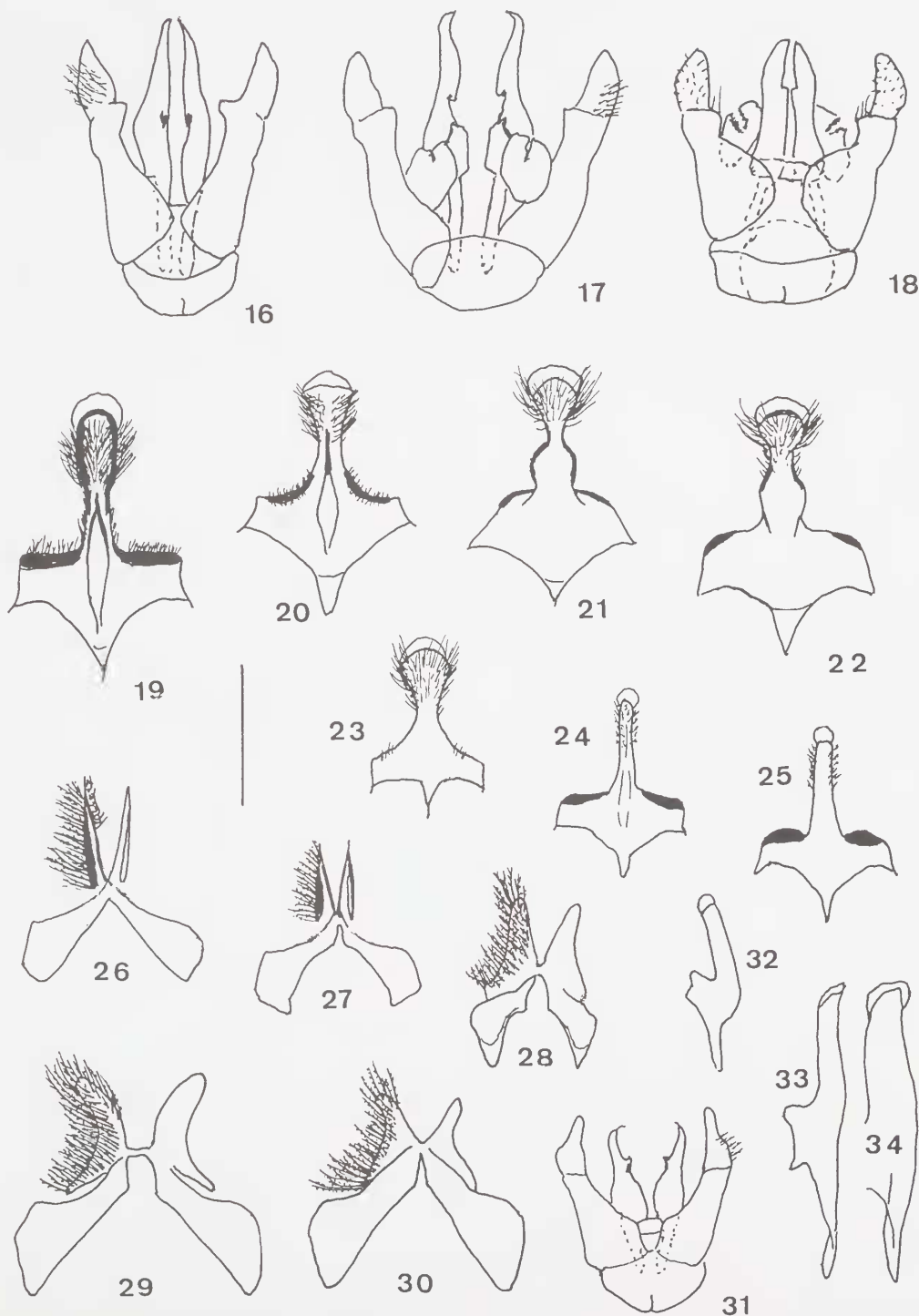
**Western Australia:** holotype ♀, 10.5km S Eneabba (29°49'S, 115°16'E), 3–4 November 1992, T.F. Houston, on flowers of *Verticordia argentea* (WAM). Paratypes: **Western Australia:** 5♀, 2♂ same data as holotype (WAM, ANIC, UQIC).

## Description

## Female

Length about 6.5mm; wing length about 4.0mm. Relative head measurements: width 4.4; length 4.6; eye length 3.3; lower interocular distance 2.5; upper interocular distance 3.0; interantennal distance 0.5; antennocular distance 0.6; interocellar distance 1.0; ocellocular distance 0.6; labrum length 0.3, about 2.75 x as wide as long.

Facial foveae curving faintly towards lateral ocelli; genal area not visible from side behind anterior part of eye; gastral foveae about 4 x as long as wide; inner hind tibial spur with 6–7 teeth; head and mesosoma black, antennal flagellum with segments 4–10 yellowish ventrally; legs dark brown with spot of yellow on base of fore tibia; metasoma orange/brown; veins and margins of pterostigma dark brown; long white setae on mesosoma, legs, venter; long golden setae on  $T_5$ ,  $T_6$ ,  $S_6$ . Punctuation most dense on frons.



Figures 16–34 Males of *Dasyhesma* spp. Scale line = 0.5 mm. 16–18 Genitalia. 16 *D. scholtziae* dorsal view; 17 *D. aurea* ventral view; 18 *D. simulata* dorsal view. 19–25 Eighth metasomal sternum Ventral view: 19 *D. aurea*; 20 *D. scholtziae*; 21 *D. arcola*; 22 *D. simulata*; 23 *D. brevipalpa*; 24 *D. lepidophyllae*; 25 *D. clypeata*. 26–30 Seventh metasomal sternum Ventral view: 26 *D. clypeata*; 27 *D. lepidophyllae*; 28 *D. brevipalpa*; 29 *D. aurea*; 30 *D. simulata*. 31 Genitalia *D. argentea*. 32–34 Seventh metasomal sternum Side view: 32 *D. argentea*; 33 *D. galbina*; 34 *D. aurea*

*Male*

Length about 4.0mm; wing length about 3.5mm. Relative head measurements: width 3.5; length 3.7; eye length 2.5; lower interocular distance 1.9; upper interocular distance 2.2; interantennal distance 0.5; antennocular distance 0.4; interocellar distance 0.7; ocellular distance 0.6.

Colour black with on distal half of each femur a streak of yellow dorsally.

Genitalia: Figure 31.

Seventh metasomal sternum: Figure 32.

**Remarks**

The male terminalia are similar to Figures 24–27 and raise doubts about the accuracy of the sex association.

**Etymology**

The specific name is taken from the species of *Verticordia* on which the bees were caught.

*Dasyhesma clypeata* sp. nov.

Figures 5, 10, 25, 26

**Types**

**Western Australia:** holotype ♀, Bungabandi Ck, 16.5km 40°N of W from Eurardy HS, 27°28'25"S, 114°32'58"E, 5 November 1999, T.F. Houston, on flowers of *Chamelaucium oenanthum* (WAM). Paratypes: **Western Australia:** 8♀, same data as holotype (WAM, ANIC, UQIC).

**Additional Material Examined**

**Western Australia:** 3♀, 24♂, 9km NNE of Eurardy HS on NW Coastal Highway, 25–28 October 1996, T.F. Houston, on or flying around flowers of *Chamelaucium oenanthum* (WAM).

**Description***Female*

Length about 7.0mm; wing length about 4.5mm. Relative head measurements: width 5.0; length 5.2; eye length 3.7; lower interocular distance 3.0; upper interocular distance 3.3; interantennal distance 0.8; antennocular distance 0.9; interocellar distance 1.1; ocellular distance 0.8; labrum length 0.3, about 3.3 x as wide as long.

Clypeus viewed from the side strongly convex from the level of anterior end of eyes; facial foveae linear, curving towards lateral ocelli; basitibial plate margined by carinae and tubercles; inner hind tibial spur with 6–7 teeth; metasomal foveae shallow groove, about 5 x as long as wide.

Head including mouthparts and mesosoma very black with tips of mandibles red and last 7 antennal flagellar segments conspicuously yellow ventrally; metasoma orange with black infuscations; fore and

mid legs black, hind legs orange; forewings with veins and margins of pterostigma dark brown; apex of marginal cell separated from wing margin by about 2 vein widths; clypeus very highly polished, not heavily punctured. Long white hairs on leg bases, ventral body surface; extensive golden pubescence on T<sub>5</sub>, T<sub>6</sub> and S<sub>6</sub>.

*Male*

In the presumed males of this species the propodeal triangle is covered with small punctures and its horizontal portion is larger than elsewhere in the genus.

Length about 5.0mm; wing length about 3.0mm. Relative head measurements: width 3.8; length 4.6; eye length 3.6; lower interocular distance 2.0; upper interocular distance 2.6; interantennal distance 0.6; antennocular distance 0.5; interocellar distance 0.8; ocellular distance 0.6; labrum not triangular, length 0.2.

Colour black with antennal flagellar segments yellow ventrally and all legs with all coxae and trochanters black and femora distally, fore tibiae dorsally, mid and hind tibiae ventrally and all tarsi yellowish.

The clypeus although heavily obscured by long white setae is curved as in the female.

Seventh metasomal sternum: Figure 26.

Eighth metasomal sternum: Figure 25.

**Remarks**

The male propodeum and terminalia raise doubts about the sex association.

**Etymology**

The specific name is from the Latin and draws attention to the large, black, curved, polished clypeus of the female: the 'shield'.

*Dasyhesma depressa* sp. nov.

Figure 7

**Types**

**Western Australia:** holotype ♀, Red Bluff, 6 November 1971, D.N. McFarland, (ANIC). Paratypes: **Western Australia:** 2♀, same data as holotype (ANIC, UQIC).

According to my gazetteer, there are at least five Red Bluffs in Western Australia but Dr Houston (WAM) considers just south of the Kalbarri township the likely site as the collector was known to visit in that area.

**Description***Female*

Length about 8.0mm; wing length about 5.0mm. Relative head measurements: width 5.4; length 5.6;





Figure 35 Known distribution of some bees of the genus *Dasyhesma*.

eye length 4.2; lower interocular distance 3.5; upper interocular distance 3.7; interantennal distance 1.0; antennocular distance 0.9; interocellar distance 1.2; ocellocular distance 1.0; labrum length 0.4; labial palp segment one longest; genal area narrower than eye seen from the side; malar space clearly evident; basitibial plate delineated by posterior carina only; inner hind tibial spur with 3–5 teeth; foveae of second tergum of metasoma about 6 x as long as wide; black in holotype.

Head, mesosoma and legs 1 and 2 black; leg 3 orange; metasoma yellow-orange marked with black (in holotype, anterior half of terga 1–3 is black).

Head and mesosoma very highly polished, not heavily punctured. Clypeus flat and supraclypeal area depressed resulting in a hollow in the middle of the face. Some long white setae on ventral body and base of legs, long cream setae on  $T_5$ ,  $T_6$ .

#### Remarks

This species is quite different from others in Group 2. In addition to the characters mentioned, setae on the foretarsi resemble those on females of Group 1 and the tarsal claws are smaller, outer ramus not very right-angled and with no tooth visible on fore legs.

#### Etymology

The specific name is from the Latin and refers to the 'pressed down' appearance of the middle of the face.

*Dasyhesma forrestii* sp. nov.

Figure 15

#### Types

Western Australia: holotype ♀, 7km N of

Boologooro HS (24°39'S, 113°42'E), 27–29 August 1980, C.A. Howard and T.F. Houston, on flowers of *Verticordia forrestii* (WAM). Paratypes: **Western Australia**: 1♀, 7♂, same data as holotype (WAM).

#### Additional Material Examined

**Western Australia**: 2♀, 16km WSW Yannarie River Xing, NW Coastal Highway, 30 September 1997, T.F. Houston and P. Mathiasen, on flowers of *Verticordia forrestii*; 8♀, 121mi NNE of Carnarvon, 22 August 1971, T.F. Houston, on *Verticordia* (WAM).

#### Description

##### Female

Length about 8.0mm; wing length about 5.0mm. Relative head measurements: width 5.5; length 5.3; eye length 4.1; lower interocular distance 3.0; upper interocular distance 3.6; interantennal distance 0.7; antennocular distance 0.9; interocellar distance 1.1; ocellular distance 1.0; length of labrum 0.4, about 2.75 x as wide as long.

Genal area narrower than eye seen from the side; basitibial plate indicated by a carina and tubercle posteriorly and short anterior carina; inner hind tibial spur with 4–5 teeth; foveae of second tergum of metasoma 4 x as long as wide, dark brown.

Head and mesosoma black; legs brown with both ends of all tibiae yellowish; metasoma very variable orange brown with areas of black.

Longish white hair on head, mesosoma, ventral metasoma with dense cream setae on T<sub>5</sub> and T<sub>6</sub>.

##### Male

Length about 6.0mm; wing length about 5.0mm. Relative head measurements: width 4.7; length 4.4; eye length 3.4; lower interocular distance 2.0; upper interocular distance 3.0; interantennal distance 0.6; antennocular distance 0.6; interocellar distance 0.9; ocellular distance 0.6; length of labrum 0.2, about 4.5 x as wide as long.

Head and mesosoma black, metasoma dark brown; antennae black with flagellum light brown ventrally, legs dark brown with yellowish tarsi and knees, plentiful long white hair on head, mesosoma, legs and ventral metasoma.

#### Remarks

Code numbers in Houston (2000): F301/M265.

#### Etymology

The specific name is taken from the species of *Verticordia* on which most specimens were taken.

#### *Dasyhesma galbina* sp. nov.

Figures 11, 13, 33

#### Description

##### Types

**Western Australia**: holotype ♀, 13km S of Wannoo (26°49'S, 114°37'E), 24 October 1996, T.F. Houston, on flowers of *Verticordia dichroma* var. *syntoma* (Myrtaceae) (WAM). Paratypes: **Western Australia**: 3♀, 6♂, same data as holotype (WAM, ANIC, UQIC).

#### Additional Material Examined

**Western Australia**: 1♀, 51km, 17°E of N from Kalbarri on VP Fence, 16–19 November 1998, T.F. Houston, on flowers of *Verticordia dichroma* var. *syntoma* (WAM).

#### Description

##### Female

Length about 8.0mm; wing length about 5.0mm. Relative head measurements: width 5.1; length 5.1; eye length 3.9; lower interocular distance 2.5; upper interocular distance 3.3; interantennal distance 0.5; antennocular distance 0.8; interocellar distance 0.9; ocellular distance 0.7; labrum length 0.5, about 2 x as wide as long, margined by setae longer than mid (greatest) length of labrum; genal area less than half width of eye seen from side, almost invisible below anterior third of eye; basitibial plate indicated by anterior and posterior carinae with one or two tubercles at end of latter, less than half length of hind tibia; inner hind tibial spur with 5–7 teeth; foveae of second tergum of metasoma shallow, about 3 x as long as wide, difficult to distinguish.

Head and mesosoma black with terminal segments of labial (2–4) and maxillary palps (4–6) pale yellow, remaining segments dark brown; antennae black with pedicel and flagellar segments 4–10 yellow ventrally; metasoma and legs except fore coxae which are black, yellow/orange.

##### Male

Length about 6.0mm; wing length about 4.0mm. Relative head measurements: width 4.4; length 4.5; eye length 3.2; lower interocular distance 2.1; upper interocular distance 3.0; interantennal distance 0.5; antennocular distance 0.6; interocellar distance 0.9; ocellular distance 0.7; labrum length 0.3, about 3 x as wide as long.

Head and mesosoma black/dark brown with antennal flagellar segments yellowish below; labial and maxillary palps dark brown; legs dark brown with ends of all femora, at least the inner surface of tibiae and all tarsi yellow; metasoma dark brown with T<sub>7</sub> yellowish.

Seventh metasomal sternum: Figure 33.

**Etymology**

The specific name is from the Latin meaning yellowish in reference to the colour of the terminal segments of the palps, parts of the antennae and all legs of the female.

*Dasyhesma lepidophyllae* sp. nov.

Figures 24, 27

**Types**

**Western Australia:** holotype ♀, 51km 17°E of N from Kalbarri on VP Fence, 27°15'22"S, 114°19'58"E, 25–27 October 1998, T.F. Houston and O. Mueller, on flowers of *Verticordia lepidophylla* var. *quantula* (Myrtaceae) (WAM). Paratypes: **Western Australia:** 6♀, same data as holotype (WAM, UQIC).

**Additional Material Examined**

**Western Australia:** 1♀, Bungabandi Ck, 19km 38° N of W from Eurardy HS, 9 November 1999, T.F. Houston on flowers of *Verticordia lepidophylla* var. *lepidophylla*; 2♂, same data except 'flying near flowers' at 16.5km 40°N of W from Eurardy HS (WAM); 2♀, 10km N of Binu 23 November 1988.R.A. Snelling and J. Gray on flowers of *Grevillea* sp (Proteaceae) (LAM).

**Description***Female*

Length about 7.0mm; wing length about 5.0mm. Relative head measurements: width 5.3; length 4.9; eye length 3.8; lower interocular distance 2.7; upper interocular distance 3.4; interantennal distance 1.0; antennocular distance 0.8; interocellar distance 1.3; ocellocular distance 0.8; labrum length 0.3, about 3.3 x as wide as long.

Genal area very narrow under anterior half of eye when seen from side; inner hind tibial spur with 3–4 teeth; gastral foveae difficult to see, about 4 x as long as wide.

Head black with antennal flagellar segments 4–10 yellowish ventrally; mesosoma black; fore legs black with base of tibiae yellowish; mid and hind legs orange with last tarsal segment black/dark brown.

Clypeus with fewest punctures; clypeus and propodeal triangle highly polished; long white hairs on ventral body, shorter on tops of head and thorax, long golden setae on  $T_5$ ,  $T_6$ .

*Male*

Length about 4.5mm; wing length about 3.5mm. Relative head measurements: width 3.7; length 3.7; eye length 2.6; lower interocular distance 1.8; upper interocular distance 2.5; interantennal distance 0.6; antennocular distance 0.4; interocellar distance 1.0; ocellocular distance 0.6; labrum not triangular, length about 0.1, 6 x as wide as long.

Head black with underside of antennal flagellum yellowish; mesosoma black, legs black with all femora apically, fore tibiae dorsally and first tarsal segments yellowish; metasoma dark brown. Long white setae on head, mesosoma and legs.

Seventh metasomal sternum: Figure 27.

Eighth metasomal sternum: Figure 24.

**Remarks**

The male terminalia raise doubts about the sex association. The two specimens in LAM are the only records of females not on Myrtaceae.

Code number in Houston(2000): F399.

**Etymology**

The specific name refers to the species of *Verticordia* on which the type specimens were found.

*Dasyhesma muelleriana* sp. nov.

Figure 9

**Types**

**Western Australia:** holotype ♀, Watheroo National Park (N.W.Corner), 30°11'S, 115°44'E, 15–16 November 1997, T.F. Houston, on flowers of *Verticordia muelleriana muelleriana* (Myrtaceae) (WAM). Paratypes: **Western Australia:** 2♀, same data as holotype (WAM, UQIC).

**Description***Female*

Length about 7.0mm; wing length about 5.0mm. Relative head measurements: width 5.0; length 5.1; eye length 3.8; lower interocular distance 2.8; upper interocular distance 3.2; interantennal distance 0.6; antennocular distance 0.8; interocellar distance 1.1; ocellocular distance 0.8; labrum length 0.4, about 2.5 x as wide as long.

Clypeus with anterior margin truncate, well below lower level of eyes, seen in profile convex; facial foveae about one third length of eyes, curving slightly towards lateral ocelli; genal area less than half as wide as eye seen from side (almost invisible below anterior third of eye); gastral foveae about 3 x as long as wide. Head including maxillary and labial palps and mesosoma black; metasoma reddish brown; fore and mid legs dark brown, hind legs basally dark brown, tibiae and tarsi brown; forewing with pterostigma yellow, veins and margins of pterostigma dark brown, clypeus and supraclipeal area least heavily punctured; pubescence long, white, on vertex and genae, mesosoma (including legs), venter; long brownish setae on  $T_5$ ,  $T_6$ .

**Remarks**

The distinctly yellow opaque pterostigma differs from the usual transparent, yellowish-brown with dark brown margins.

**Etymology**

The specific name refers to the species of *Verticordia* on which the specimens were found.

*Dasyhesma robusta* Michener

*Dasyhesma robusta* Michener, 1965: 284–285

**Types**

**Western Australia:** holotype ♀, Pearce, 6 January 1956, A.M. Douglas (WAM). Paratypes: **Western Australia:** 2♀, same data as holotype (WAM); 1♀, same data on 1 January 1956 (WAM); allotype ♂, Capel, 2 January 1941, P.N.F. (WAM); 4♀, same data as allotype (KU).

**Description**

See Michener, 1965 pp. 284–285.

The following measurements are for comparison with other species described.

*Female*

Length about 8.0mm; wing length about 5.0mm. Relative head measurements: width 6.0; length 5.1; eye length 4.0; lower interocular distance 2.9; upper interocular distance 4.1; interantennal distance 0.9; antennocular distance 0.8; interocellar distance 1.2; ocellular distance 1.0.

*Male*

Length about 7.0mm; wing length about 5.0mm. Relative head measurements: width 5.0; length 4.4; eye length 3.1; lower interocular distance 2.1; upper interocular distance 3.5; interantennal distance 0.8; antennocular distance 0.7; interocellar distance 1.1; ocellular distance 0.9.

**Remarks**

The specimen from Bullsbrook numbered 46-2576 in WAM although labelled by Michener "Paratype *Dasyhesma robusta*" is here identified as *D. scholtzia*.

*Dasyhesma simulata* sp. nov.

Figures 18, 22, 30

**Types**

**Western Australia:** holotype ♀, 13km 35°S of W from Eurardy HS, 27°37'52"S, 114°34'01"E, 6–9 November 1999, T.F. Houston, on flowers of *Verticordia dichroma* var. *dichroma* (WAM). Paratypes: **Western Australia:** 1♀, same data as holotype; 1♂, 11.5km 24°S of W from Eurardy HS,

27°36'30"S, 114°33'59"E; 1♂, 10.5km W of Eurardy HS, 27°33'45"S, 114°33'59"E, both males, 6 November 1999, T.F. Houston, on flowers of *Verticordia dichroma* var. *dichroma* (WAM).

**Additional Material Examined**

**Western Australia:** 7♂, 10km WNW of Eurardy HS, 21–24 October 1998, T.F. Houston and O. Mueller, on flowers of *Verticordia dichroma* var. *dichroma* (WAM).

**Description***Female*

Length about 8.0mm; wing length about 5.0mm. Relative head measurements: width 5.1; length 5.2; eye length 4.0; lower interocular distance 2.7; upper interocular distance 3.4; interantennal distance 0.7; antennocular distance 0.8; interocellar distance 1.0; ocellular distance 0.8; labrum length 0.5, about 2 x as wide as long.

Basitibial plate margined by posterior carina terminating in one tubercle; inner hind tibial spur with 5 teeth.

Colour as in *galbina* with less yellow – labial palp segments 3 and 4 pale, antennal flagellar segments 4–10 yellow ventrally, fore legs predominantly dark brown not yellow-orange.

*Male*

Length about 7.0mm; wing length about 5.0mm. Relative head measurements: width 4.7; length 4.6; eye length 3.5; lower interocular distance 2.3; upper interocular distance 3.2; interantennal distance 0.4; antennocular distance 0.5; interocellar distance 0.9; ocellular distance 0.8; labrum length 0.3, about 2.7 x as wide as long.

Very similar to *galbina* except in size and with labrum more sharply triangular, less yellow colouring and T<sub>1</sub> dark brown.

Genitalia: Figure 18.

Seventh metasomal sternum: Figure 30.

**Remarks**

Both sexes resemble *D. galbina* differing in size and colouring. In both species segment 2 of the labial palps is large, about 0.75 x length of segment 3.

Both *D. galbina* and *D. simulata* were associated with *Verticordia dichroma* on the different varieties *syntoma* and *dichroma*.

Code number in Houston (2000): M364

**Etymology**

The specific name is from 'similis', the Latin word for like, and refers to the similarity to *D. galbina*.

*Dasyhesma spicata* sp. nov.



**Type**

**Western Australia:** holotype ♀, 54km, 27°E of N from Kalbarri on VP Fence, 27°16'02"S, 114°25'15"E, 24 November 1998, T.F. Houston, on flowers of *Verticordia spicata* (WAM).

Two females were collected at this site on this date, one on flowers of *V. spicata*, the other on flowers of *V. spicata* × *dichroma*. They differ particularly in shape of head and colouration.

In his revision of *Verticordia*, George (1991) cited hybrids. It is interesting that the bee on the hybrid is *D. syntoma* without the usual dark colour to the last tarsal segments of legs 2 and 3.

**Description***Female*

Length about 7.0mm; wing length about 4.5mm. Relative head measurements: width 5.0; length 4.9; eye length 3.6; lower interocular distance 2.4; upper interocular distance 3.0; interantennal distance 0.7; antennocular distance 0.7; interocellar distance 1.0; ocellocular distance 0.6; labrum length 0.4, about 2.5 × as wide as long.

Facial foveae reaching level of ocelli; gastral foveae not seen; basitibial plate with anterior and posterior carinae each terminating in a tubercle; forewing with veins and margins of pterostigma dark brown; head and mesosoma black, metasoma orange brown; fore and mid legs with coxae, trochanters and femora black; hind legs and tibiae and tarsi of mid legs orange/yellow; fore tibiae brown marked with yellow; fore tarsi brown.

Punctures surrounding ocelli and mesonotum almost touching, on clypeus sparse; propodeum polished.

Longish white setae on ventral body surface; short, white setae on dorsum of head and mesonotum.

**Etymology**

The specific name is taken from the species of *Verticordia* on which it was found.

*Dasyhesma syntoma* sp. nov.

Figure 3

**Types**

**Western Australia:** holotype ♀, 51km 17° E of N from Kalbarri on VP Fence, 27°15'19"S, 114°19'58"E, 16–19 November 1998, T.F. Houston, on flowers of *Verticordia dichroma* var. *syntoma* (Myrtaceae) (WAM). Paratypes: **Western Australia:** 4♀, 1♂, same data as holotype (WAM, UQIC).

**Additional Material Examined**

**Western Australia:** 1♀, 9km S of Nerren Nerren HS on NW Coastal Highway, 25 October 1996, T.F.

Houston, on *Verticordia dichroma* var. *syntoma* (WAM).

**Description***Female*

Length about 7.0mm; wing length about 5.0mm. Relative head measurements: width 4.8; length 5.0; eye length 4.0; lower interocular distance 2.5; upper interocular distance 3.2; interantennal distance 0.7; antennocular distance 0.7; interocellar distance 1.0; ocellocular distance 0.7; labrum length 0.4, about 2.5 × as wide as long.

Labial palps with segment 3 about 2.5 × length of segment 2; genal area narrower than eye seen from the side; basitibial plate margined by carinae with two tubercles at end of posterior carina; inner hind tibial spur with 5–7 teeth; foveae of second tergum of metasoma about 6 × as long as wide.

Head black with labial palps dark brown; labrum and underside of last seven segments of antennal flagellum yellow-brown; mesosoma black with coxae, trochanters and femora of fore legs black, tibiae and tarsi of fore legs and all mid and hind legs orange; metasoma orange. Long white hair on underside of body, shorter on dorsum, clypeus sparsely punctured.

*Male*

The only male collected with females is in pieces and the length cannot be measured.

Wing length about 5.0mm. Relative head measurements: width 4.8; length 4.5; eye length 3.5; lower interocular distance 2.2; upper interocular distance 3.1; interantennal distance 0.4; antennocular distance 0.6; interocellar distance 1.0; ocellocular distance 0.9. Anterior margin of clypeus slightly concave; labrum length 0.3, about 3 × as wide as long.

**Remarks**

*D. syntoma* was collected on the same variety of *Verticordia dichroma* as *D. galbina*. Most obvious distinctions in females relate to length and colour of segments of labial palps and colour of legs.

Code number in Houston (2000): F399.

**Etymology**

The specific name refers to the variety of *Verticordia dichroma* on which specimens were collected.

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